Non-exporting Storage Interconnection

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Introduction

Stem's experience in interconnection:

- **Interconnected under Rule 21 as non-exporting, 100% approval rate**
- **Equipment safety: UL-ratings on both inverters and storage**
- **Received PTO for systems in all CA IOU territories**
- **Have also co-located with solar and other DG**
- **Participating in IRM2 wholesale market pilot**

Paid over $45,000 in interconnection fees for first 1.5MW

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Benefits of Non-Exporting Resources

- **There is a technical limit to interconnecting exporting resources and accordingly an interconnection process to evaluate saturation and effective interconnection.**
- **There is no technical limit to interconnecting non-exporting resources.**
- **No "first mover" advantage where early interconnections are favored over later interconnections : every ratepayer could participate equally with non-exporting resources.**
- **Supports transition from NEM. Reduce system ramp challenge.**
- **Relative to exporting resources, Rule 21 process today unnecessarily impedes non-exporting resources even though non-exporting resources can be interconnected safely and simply.**

"Interconnection requirements for a non-exporting generating facility are considered simplified because there is no risk of reverse power flow to the electric System and of unintended "islanding.""

http://www.pge.com/en/b2b/energytransmissionstorage/egi/grid/rule21/selfgenoptions/index.page

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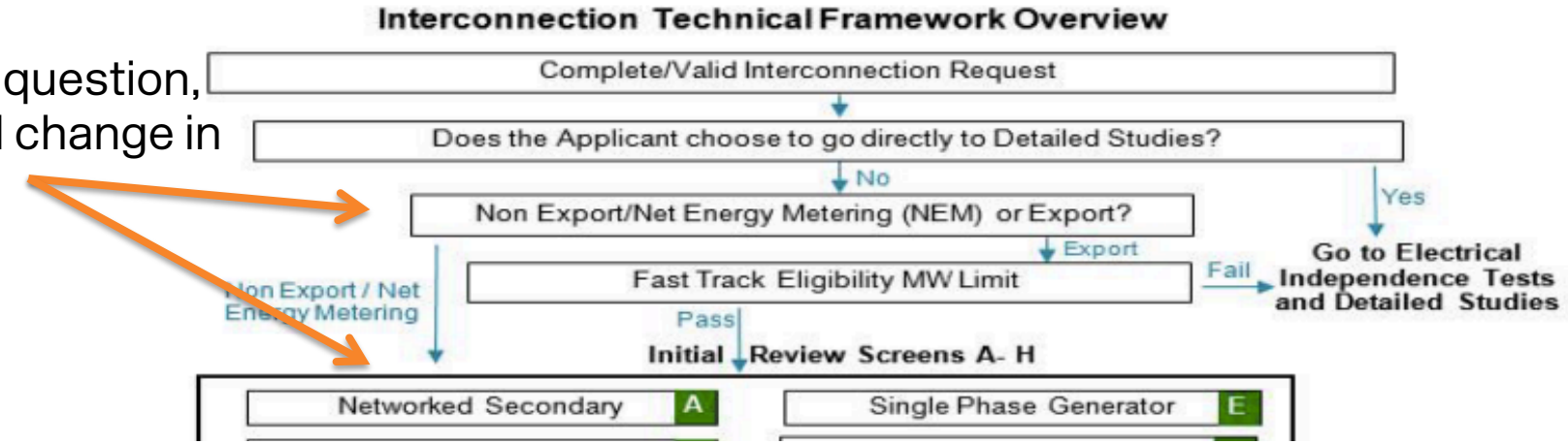
Non-exporting resources are different from exporting
Yes the interconnection process is not differen

1st material question, no material change in process



Source: PG&E Rule 21, Sheet 118

From a distribution planning perspective, non-exporting resources are not significantly different than normal load volatility or operating a motor.

- **No injection of current past the PCC**
- **No technical limitation: no circuit PV saturation**
- **No distribution voltage impact: equivalent to load variation for planning**
- **Significantly less overvoltage and short circuit concerns versus exporting resources, yet exporting resources are relatively favored.**

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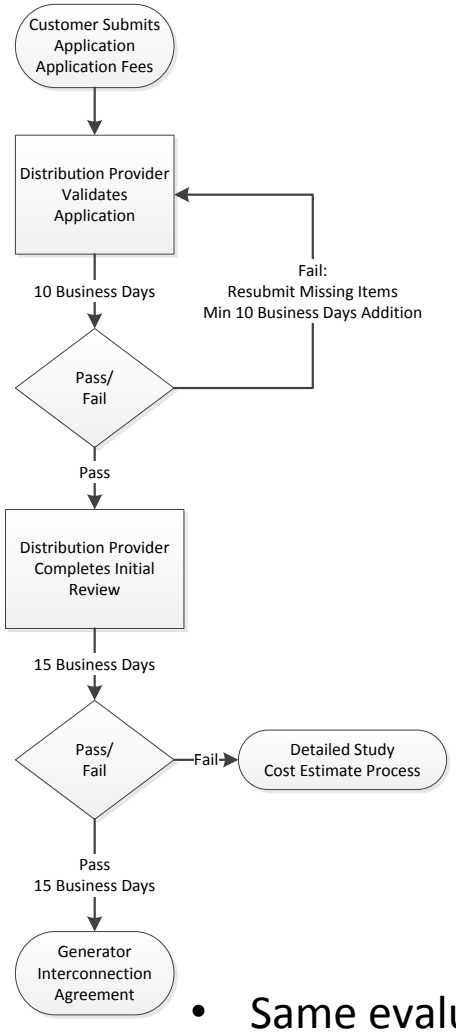
"Fast-Track" Interconnection Comparison



Resource	Machine Type	Interconnection	Business Days	Fees
1 MW NEM Solar	Inverter	Exporting	≥ 40	$0
1MW NEM Solar 1MW Storage	Inverter	Exporting Solar Non-Exporting Storage	≥ 40	$0
1 MW NEM Eligible	Synchronous Machine	Exporting	≥ 40	$0
1 MW NEM Eligible	Synchronous Machine	Non-Exporting	≥ 40	$0
100 KW Synchronous Motor	Synchronous Machine	Contributes fault current	No Process	No Fees
100 KW Battery Storage	Inverter	Non-Exporting	≥ 40	$800
1 W Battery Storage	Inverter	Non-Exporting	≥ 40	$800

- Same evaluation process for significantly different generation applications
- Process time and fees are not commensurate with analysis effort
- Certain filters are relevant for identical concerns that are not governed by Rule 21 (e.g. synchronous motors)

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Relevant Screens: Non-Exporting Resources

Screen	Analysis	Analysis Time / Effort	Non-Exporting Relevance	LV Inverter Based Relevance	Relevant Non-Exporting LV Inverter
Screen A: Is the PCC on a Networked Secondary System?	**Check Meter #**	**Low**	**Yes**	**Yes**	**Yes**
Screen B: Is Certified Equipment used?	**Application Form**	**Low**	**Yes**	**Yes**	**Yes**
Screen C: Is the Starting Voltage Drop within acceptable limits? (only relevant for motor starting generation)	Application Form	Med	Yes	No	No
Screen D: Is the transformer or secondary conductor rating exceeded?	Distribution System Analysis	Med	No	No	No
Screen E: Does the Single-Phase Generator cause unacceptable imbalance?	Distribution System Analysis	Med	No	No	No
Screen F: Is the Short Circuit Current Contribution Ratio within acceptable limits? (Greater than 11 kVA Only)	**Application Form**	**Low**	**Yes**	**Yes**	**Yes**
Screen G: Is the Short Circuit Interrupting Capability Exceeded? (Greater than 11 kVA Only)	Application Form Distribution Analysis	Med	No	No	No
Screen H: Is the line configuration compatible with the Interconnection type?	**Check Meter #**	**Low**	**Lower than Exporting**	**Lower than rotating**	**Very Low**
Screen I: Will power be exported across the PCC?	**Application Form**	**Low**	**Yes**	**Yes**	**N/A**
Screen J: Is the Gross Rating of the Generating Facility 11 kVA or less?	Application Form	Low	No	Yes	No
Screen K: Is the Generating Facility a Net Energy Metering (NEM) Generating Facility with nameplate capacity less than or equal to 500kW?	Application Form	Low	No	Yes	No
Screen L: Transmission Dependency and Transmission Stability Test	Distribution System Analysis	High	No	No	No
Screen M: Is the aggregate Generating Facility capacity on the Line Section less than 15% of Line Section peak load for all line sections bounded by automatic sectionalizing devices?	Distribution System Analysis	High	No	Yes	No

Only Five Screens Are Applicable for Non-Exporting, Inverter-Based Generation

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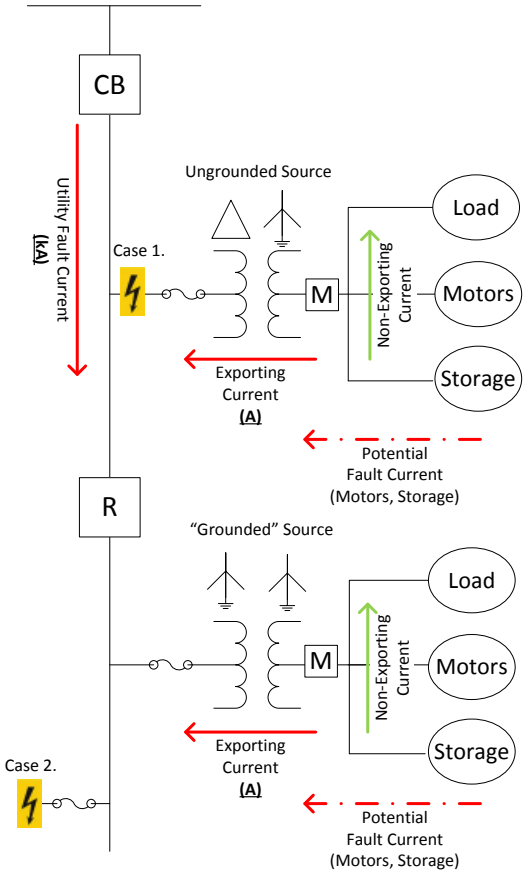
Faults and Overvoltage: Non-Exporting Resources

Fault Conditions (related to Screen F and Screen G)

- Non-exporting resources do not inject current to feeder as with exporting resources. Available fault current minimal due to both load on same bus and impedance.
- Non-exporting fault current contribution minimal both for fault conditions near non-exporting bus (Case 1.) or elsewhere on the feeder (Case 2.).
- Transformer connection type and distribution line type impacts whether resource could even provide ground current.

Overvoltage Transients (related to Screen H)

- Risks from neutral shift due to single phase fault and/or exporting significant load during transient islanded conditions.
- In addition to anti-islanding protection, non-exporting resources cannot materially contribute to overvoltage as generation is less than the load on the same bus behind the PCC.
- Transformer connection and distribution line type also determines whether there is overvoltage risk when circuit breaker (CB) and/or recloser (R) opens.



Non-exporting inverter-based resources have minimal and materially different considerations to protection, fault or voltage transient versus exporting resources. A similar approach to motors, which are not within Rule 21, could be applied.

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Proposed Process: Non-Exporting Inverter Resources

Screen	Data Source	Distribution Provider Action	Analysis Time / Effort
Screen A: Is the PCC on a Networked Secondary System?	Check Meter #	Confirm meter is not on Secondary Network.	Low
Screen B: Is Certified Equipment used?	Application Form	Review equipment documentation. Same equipment used for multiple interconnections.	Low
Screen F: Is the Short Circuit Current Contribution Ratio within acceptable limits? (Greater than 11 kVA Only)	Application Form	Divide equipment short circuit current by service interrupting ratings.	Low
Screen H: Is the line configuration compatible with the Interconnection type?	Check Meter #	Confirm primary line and transformer connection type (*primarily for distribution planning purposes only)	Low
Screen I: Will power be exported across the PCC?			
Option 1: Reverse Power Protection	Application Form	Review single line diagram	Low
Option 2: Minimum Power Protection	Application Form	Review single line diagram	Low
Option 3: Certified Non-Islanding Protection	Application Form Check Meter #	Review equipment non-islanding documentation. Check rating against service rating, transformer rating.	Low
Option 4: Relative Generating Facility Rating	Application Form Check Meter #	Review resource parameters against minimum load	Med
Option 5: Inadvertent Exporting	Application Form Distribution Parameters	Review resource parameters against conductor ratings, largest load block, etc.	Med

Non-Exporting workflow can be improved and simplified: no studies/analysis required

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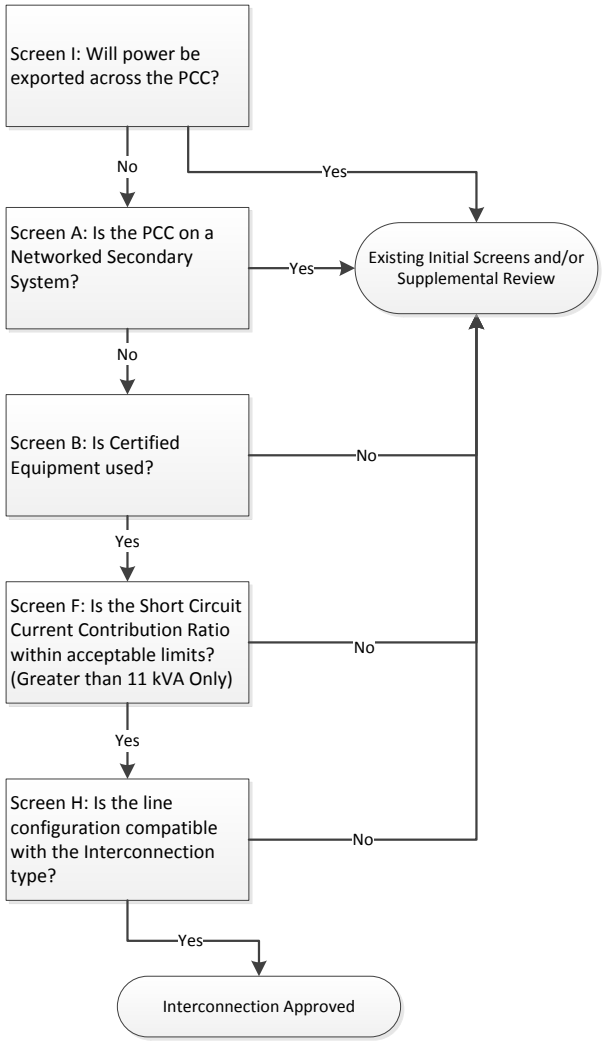

Similar to screens J and K, the Exporting versus Non-Exporting (Screen I) should be the initial branch screen to determine which other relevant screens to apply.

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Proposed Rule 21 Modification

- **Non-Exporting resources, particularly inverter based, should have a "notification" process rather than an "review and approve" process as with exporting resources.**

- **Change the screen workflow to speed non-exporting inverter-based storage reviews.**
  - Resource parameters and equipment certification
  - Meter number
  - Single Line (or "Site Plan") with "relevant details"

- **Non-Exporting resources should have shorter processing times versus exporting resources based on relative effort level.** 5 Business Days is reasonable cycle time based on relative effort level to exporting resources.

- **Non-Exporting resources should not have a Interconnection Request fee** relative to more intensive processes that are imposed either zero or same fees as non-exporting today.

- **Standard Commercial Agreement and Investigate Using Metering for Additional Non-Exporting Enforcement**
  - Standard Form should take less than 15BDs: Non-Exporting Interconnection Agreement
  - Utilize contract for enforcement and existing utility metering at PCC to review for violations

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